

SOUTHARD (W.F.)

AN EXAMINATION OF THE EYES
OF 311 STUDENTS,
WITH CHARTS.

BY

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An Examination of the Eyes of 311 Students with Charts.*

By W. F. SOUTHARD, M. D., (Harv.)
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Dr. F. H. Payne, Director of Physical Culture, University of California:

DEAR DOCTOR:—During the spring of 1889, I made, at your invitation, a test examination of a number of students to determine, as far as possible, what proportion had defective vision. This test was undertaken to supplement the work of your department, the physical examination of the students being thus made more complete. There was no attempt at this time to make these examinations exhaustive. Owing to the time at my disposal being limited, and the examinations being conducted at the university, I succeeded in examining but eighty-four students. They were from all the classes and were examined at hours of the day most convenient to meet them, generally, however, late in the afternoon. The room being too small for the twenty-foot test, and improperly lighted, we could not expect accurate results.

An examination of these few test cases convinced me that other examinations should be made at some future time in a more thorough and systematic manner.

Briefly, the results then obtained were as follows: Of eighty-four students, forty persons (or 47.61 per cent.) were found to have defective vision, in one or both eyes; that is, they were either myopic, hyperopic or astigmatic.

My., four persons or 4.76 per cent.

Hy., twenty-five persons or 29.76 per cent.

Ast., eleven persons or 13.9 per cent.

Thirty persons, or 35.71 per cent, by chart test, less than normal vision.

We have, then, ten students, or 11.90 per cent, where error of refraction was determined by other means. This was done by aid of the ophthalmoscope.

The smallness of the number examined, necessarily gives but an approximation to the actual percentages of errors existing among any body of students of the same ages. With even these

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few data, the utility of such an examination must be at once apparent to any one giving the slightest thought to the subject.

A verbal report only of these test cases was made at the time, it being thought best to wait until a larger number of examinations could be collected before giving a written report.

I made my next series of examinations at the commencement of the next academic year, 1890, and gave my time to the Freshman Class only. The number then examined was one hundred and seventy-one. For this examination, I prepared a blank form divided into spaces for name, age, class, color of hair and eyes, amount of vision by chart test, refraction by ophthalmoscopic tests, also a space for remarks. Under the latter head a record was made of everything like opacities of cornea or media, peculiarities of vascular system of disk or retina, including pulsations of vessels on disk; unusually deep porous opticus, or unusual distribution of opaque nerve fibers; also subjective symptoms, such as blurring of vision when using eyes at short range, headache—persistent or otherwise, etc.

This set of examinations was put aside until I could examine another class.

My last examination was the unusually large Freshman Class of last season. More than two hundred were tested, and of this number sixty-four were ladies. At the close of my work, which had taken a great deal of my time, I found when I looked for my papers that a large number had in some way been misplaced, thus causing a loss of material and much valuable time. By good fortune, I had the ladies' papers in my possession, and enough of the gentlemen's to swell the number to one hundred and thirty-eight. These, together with the previous class, made three hundred and eleven, all Freshmen of the two classes of '94 and '95. The eighty-four test cases are not included. I have taken these three hundred and eleven examinations and constructed tables covering all the points excepting the color test. I procured the worsteds for this too late for use last year. It is hoped that they can be used at the examinations this fall.

It will be seen that myopes number nineteen or 6.14 per cent, only 1.38 per cent more than the first test. The other errors, hypermetropes and astigmatics, are much higher. The fact that we have found a high percentage of visual errors is sufficient

proof that the examination is needed. The number of units is, I am sorry to say, far too small for the construction of curves having any special scientific value. For this we need thousands instead of hundreds of units. This, however, will not detract from the practical and clinical value which they surely have in drawing your attention to the fact that too many students are attempting to carry on their studies with varying degrees of eye-defects.

In every case here examined, after testing the amount of vision with the chart, the eyes were then examined with the ophthalmoscope in a dark room.

By the use of the letters and lines on the chart we are able to measure visual acuteness, detecting those eyes which fall below the standard, myopia, manifest hyperopia, and generally astigmatism when not covered by spasm of accommodation. To discover the exact error and measure of refraction, we must paralyze the accommodation with a mydriatic.

As paralyzing the accommodation is not practical for general examination, though the most accurate method known, we use the ophthalmoscope, which not only reveals the true error, but is capable of measuring the defect very closely. It has also the merit of being very quickly used.

Many students were found hyperopic who not only fulfilled the test of visual acuteness, but accepted a myopic glass before their eyes, stating that it brightened the letters. These cases are by no means uncommon. Their defect, be it hyperopia or astigmatism, is concealed or covered by the spasm of accommodation, this spasm being the result of nature's attempt to correct its own errors (usually, however, of low degrees), in many instances simulating a defect of exactly opposite character by over-correction.

It has been discovered that the great proportion of headaches and eye strain, with their attendant functional disturbances, are, as a rule, to be found at from twelve to twenty years of age; the error of refraction being comparatively of low degree. This accounts for the large percentage of those who, while having vision equal $\frac{2}{3}$, are yet sufferers with optical disturbances. Many of these students have marked functional disturbances, at the same time are pursuing their studies in entire unconsciousness that they have any visual defects. They are, as a rule, in the habit of referring annoyances, such as headache, or blur-

ring, etc., to other causes than strain in the eye. It is thus easily understood why so many, in spite of serious functional disturbances, do not seek for relief in the proper way until forced by pain in the eyes themselves, or when blurring becomes so pronounced that there is no mistaking the cause. In the young, for a season, the powerful ciliary muscle permits them to use their eyes for all purposes, their functions being carried on apparently as well as the normal or emmetropic eye. After a time, as the student becomes engaged in more advanced studies, and the work thrown upon the eyes becomes increased, trouble is very apt to commence. The beginning is usually slight blurring, and a desire to look away from their work. Short, sharp and sudden attacks of pain are liable to follow, usually felt in the eyeballs or in the forehead above the eyes. These are often ascribed to neuralgic attacks. Muscular twitchings about the lids or face are very common. In time these disturbances become persistent enough to constantly direct the student's attention to his eyes. Among the most prominent of the objective symptoms, are red lids, accompanied with crusts; glueing together of the lids on waking in the morning, and feelings of grit and sand in the eyes, are, perhaps, the most common. When the visual error is considerable it is more apt to be discovered earlier in life, for there is not the like attempt of nature to correct the error. The error becomes manifest to a degree, and visual acuteness will be found lessened. Such cases do not, excepting in astigmatism, suffer to the same extent with functional disturbances, as in the cases previously noted. On the other hand, if one eye varies widely from its fellow in visual acuteness, it will be found that, unconsciously to the person, there is an attempt of nature to suppress the use of the eye having the least vision in order that diplopia may not prove annoying. The eye is, as it were, thrown out of gear; binocular vision is not attempted. A phenomenon here frequently perceived is an unsteadiness of the eye in its associated movements, giving it a vacillating appearance. The recti muscles which guide and support the eyes are here involved in the disturbance resulting in some of the various forms of heterophoria.¹ Otherwise than the error of refraction such an eye may be perfectly free from all pathological changes. When, therefore, the

¹ Heterophoria is a term used to denote that the eyes are out of parallelism, due to loss of power of some one or more of the recti muscles.

error is corrected and vision has been brought to the exact or nearly exact standard with its fellow, binocular vision usually takes place in persons under eighteen or twenty years of age. The eye grows stronger, the weakened muscles perform their functions as long as glasses are worn.

If we find a student having concealed or latent hyperopia or astigmatism, yet performing his daily studies without glasses, we may safely say that, before he has completed his college course, he is bound to suffer in greater or less degree with some or most of the symptoms heretofore mentioned. In other words he is handicapped at the very commencement of his life task. The advantage of correcting these errors at the beginning of his University labors is thus apparent. Many a young man entering college filled with enthusiasm for his work, and having high hopes for the future, has, in past years, been forced to leave college and take up some out of door work, entirely uncongenial to himself, and for which he may be entirely unfitted, solely and wholly on account of the failure of his eyes. An early examination and correction would, undoubtedly, have permitted them to have gone on and carried out their cherished plans. Such cases are growing less and less frequent every year. We hope that in a few years examinations shall be so universal and thorough that similar cases cannot occur.

Another point, of by no means secondary consideration, should not be overlooked. I refer to the gradual and inevitable loss of power of attention which comes upon those suffering with these various forms of refractive error. A student's standing in his class or his hopes for any great advancement in mental work, depends upon his power of self-absorption. The moment that he comes to himself, feeling that he has eyes, that moment a break takes place in the continuity of his work, and his attentions become diverted. The lost threads have to be again picked up, entailing perhaps a severe loss of time and mental strain.

Knowing, as I do, the actual present condition of many students' eyes, and the results that are constantly following neglect to correct these errors of vision, I claim that these examinations, though not great in number, are, nevertheless, of sufficient value to accentuate, in a most forcible manner, the necessity for a regular and systematic examination of every student's eyes as a part of his regular physical examination. If

the governing boards of our leading colleges and universities should insist upon this with every Freshman Class, in a few years we would hear of less students breaking down on account of the failure of their eyes. Could we go further back and have these tests made as most undoubtedly should be done, at the very commencement of school life, the gain would be correspondingly greater. Under the present method of school government in our cities and towns, there does not seem to be any immediate prospect for relief. I most unhesitatingly aver that this neglect of early examinations of children's eyes results in a great waste of nerve force at an age when there should be a conservation of energy and a storing up of strength for future use. The history of our city schools is that of a too frequent breaking down of the nervous system of pupils at from twelve to fifteen years of age. At this age latent and concealed defects of refraction generally commence to develop, causing almost invariably a greater or less disturbance to the nervous system.

I repeat, therefore, that, in my judgment, when the student takes his physical examination, not the least in practical value will be this examination of his eyes.

TABLE A.

CHART EXAMINATION.

Total number examined, 84.	NO.	PER CENT.
No. having vision equal $\frac{2}{3}0$ in both eyes.....	53	or 63.10
No. having vision less than $\frac{2}{3}0$ in one or both eyes	31	or 36.90
	84	100.00

REFRACTION MEASURED BY OPHTHALMOSCOPE.

Total number examined, 84.	NO.	PER CENT.
Number of persons having hyperopia.....	25	or 29.76
Number of persons having myopia.....	4	or 4.76
Number of persons having astigmatism.....	11	or 13.09
Total number having error of refraction.....	40	or 47.61
Total number having emmetropia.....	44	or 52.38
	84	100.00

TABLE B.

EXAMINATION OF 311 STUDENTS' EYES.

Age	Total No. Examined.	Percentage.	H. P'r et. My. P'r et. Ast. P'r et. Em. P'r et.								Total No. Errors of Refraction.	
			E.	P'r et.								
16	10	3.21	3	.96	1	.32	2	.64	4	1.28	6	1.93
17	34	10.93	13	4.18	1	.32	7	2.25	13	4.18	21	6.75
18	63	20.25	20	6.40	4	1.28	16	5.14	23	7.40	40	12.86
19	77	24.75	28	9.00	3	.96	21	6.75	26	8.36	52	16.72
20	53	17.04	17	5.45	2	.64	14	4.50	20	6.40	33	10.61
21	37	11.80	15	4.82	3	.96	7	2.25	12	3.85	25	8.03
22	16	5.14	5	1.60	2	.64	3	.96	6	1.92	10	3.21
23	6	1.92	2	.65	..	..	3	.96	1	.32	5	1.60
24	4	1.28	2	.65	1	.32	..	..	1	.32	3	.96
25	6	1.92	3	.96	2	.64	1	.32	..	..	6	1.92
26	2	.64	1	.32	..	..	..	..	..	..	1	.32
27	3	.96	2	.64	..	..	..	..	1	.32	2	.64
	11	100.00	111	35.63	19	6.09	74	23.77	107	34.35	204	65.64

TABLE C.

LADIES OF CLASS OF '95.

Age	No. of Ladies Examined.	Percentage.	H. M. Ast. Em.				Total No. of Errors.		No. having vis'n equal $\frac{2}{3}$	
			E.	Per ct.	No.	Per ct.				
16	3	4.83	1	1	..	1	2	3.22	2	3.22
17	5	8.05	2	..	1	2	3	4.83	5	8.03
18	7	11.28	1	2	2	2	5	8.03	3	4.83
19	18	29.03	9	1	4	4	14	22.58	15	24.29
20	10	16.12	1	1	1	7	3	4.83	8	12.90
21	8	12.80	..	..	3	5	3	4.83	6	9.67
22	2	3.22	..	..	1	..	1	1.61	1	1.61
23	2	3.22	1	..	1	1	2	3.22	1	1.61
24	2	3.22	1	1	..	..	2	3.22	..	..
25	3	4.83	1	2	..	..	3	4.83	1	1.61
26	..	..	..	..	..	..	..	..	..	..
27	2	3.22	2	..	..	..	2	3.22	1	1.61
	62	100.00	19	8	13	22	40	64.51	43	69.35

Percentage 30.64 12.90 20.93 35.42

TABLE D.
MALE STUDENTS OF CLASS '94-'95.

Age	No. of Male Students cls of '94-'95.	Percentage.	Errors of Refraction.						No. hav- ing vis'n equal $\frac{2}{3}$	No P'r ct		
			Per ct.	Em.	Per ct.	Ast.	Per ct.	Per ct.				
16	7	2.80							6	2.40		
17	29	11.64	11	4.40	1	.40	6	2.40	11	7.20		
18	56	22.48	19	7.60	2	.80	14	5.60	21	8.4		
19	59	23.69	19	7.60	2	.80	17	6.80	22	8.8		
20	43	17.26	16	6.40	1	.40	13	5.20	13	5.2		
21	29	11.64	15	6.00	3	1.20	4	1.60	7	2.8		
22	14	5.62	5	2.00	2	.80	2	.80	5	2.0		
23	4	1.60	1	.40	.....	.....	2	.80	1	.40
24	2	.80	1	.40	.....	.....	.....	.....	1	.40
25	3	1.20	2	.80	1	.40	3	.120	
26	2	.80	1	.40	1	.40	1	.40
27	1	.40	1	.40	
Total	249	100.00	92	36.94	11	4.81	61	24.49	85	34.12	164	65.86
												171 68.67

TABLE E.
COMPARISONS OF TABLES A, B, C AND D.

Tl No. for eachtbl Tables.	M.	H.	Per ct.	Ast.	Em.	Per ct.	Per ct.	Total Errors.	No. having less than $\frac{2}{3}$ in one or both eyes.		Per ct.	Per ct.	
									Total No. of per- sons having both eyes $\frac{2}{3}$.	No. having less than $\frac{2}{3}$ in one or both eyes.			
A	84	25	29.76	4	4.76	11	14.28	44	32.38	40	47.61	53	63.09
B	249	92	36.94	11	4.81	61	24.49	85	34.12	164	65.86	171	6.67
C	62	19	31.29	8	12.90	13	20.96	22	35.48	40	64.57	43	69.35
D	311	111	35.63	19	6.09	74	23.77	107	34.35	204	65.22	214	68.85

EXPLANATION OF CHARTS.

Table "A" is a summary of my first eighty-four test cases. The first section gives the amount of vision found by test card. This test alone gives positive evidence to the great number whose vision is below the normal. The second section gives the refraction measured by the ophthalmoscope.

Table "B" shows in detail my examination of three hundred and eleven students. Commencing at the left hand column,

take any age and read across the page; under the various headings will be found total number and percentages for that age. At the foot of the column will be found the grand totals for each refraction. The last two columns give the gross amount of errors for age, also percentage. At a glance can be seen the number who have some errors of refraction and the percentages for same. At the foot of the column it will be found that there are two hundred and four persons, or 65.64 per cent, more than one-half the students examined, who are defective in their eyes. As before stated we cannot construct a curve on account of the small number of units. It may, however, be of some interest to note that the highest point in numbers examined and errors found is at the age of nineteen. 24.75 per cent of the whole number examined, and 16.72 per cent of all errors found, are at this age. It will be somewhat interesting also to notice that the nearest in numbers examined and errors found is at the eighteenth year and that there is a difference of four per cent between them.

Knowing that you would be interested in comparing the condition of the eyes of the male and female students, I have taken the sixty-two females and the two hundred and forty-nine males which together make the three hundred and eleven of Table "B," and have drawn up separate tables, viz.: "C" and "D." At the very first inspection you will, I think, be struck with the disproportion between them if you compare them for any one age. At nineteen years of age, for example, the males number 23.69 per cent of the two hundred and forty-nine examined. The females number 29.03 per cent of their number examined. Of the males 7.60 per cent are hyperopic. Of the females 14.51 per cent are hyperopic. Taking the total errors, at nineteen years of age, males are 14.20 per cent, females 24.29 per cent, nearly double. Again, the disproportion between the nineteenth year and the next two nearest ages, eighteen and twenty, is far more marked in the females than in the males. Compare now the totals and you will find that the differences are very slight. Of the total errors there is seen to be only a difference of one per cent: males 65.86 per cent; females 64.57 per cent. Of those having vision equal $\frac{20}{24}$ in both eyes, there is only one-half of one per cent variation: males 68.67 per cent, females 69.35 per cent. Out of those having vision less than normal in one or both eyes the difference is found to be the same: males 31.32 per cent, females 30.61 per cent.

